# FIROUZI CONSULTING ENGINEER, INC.

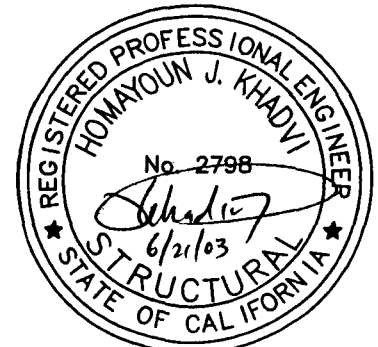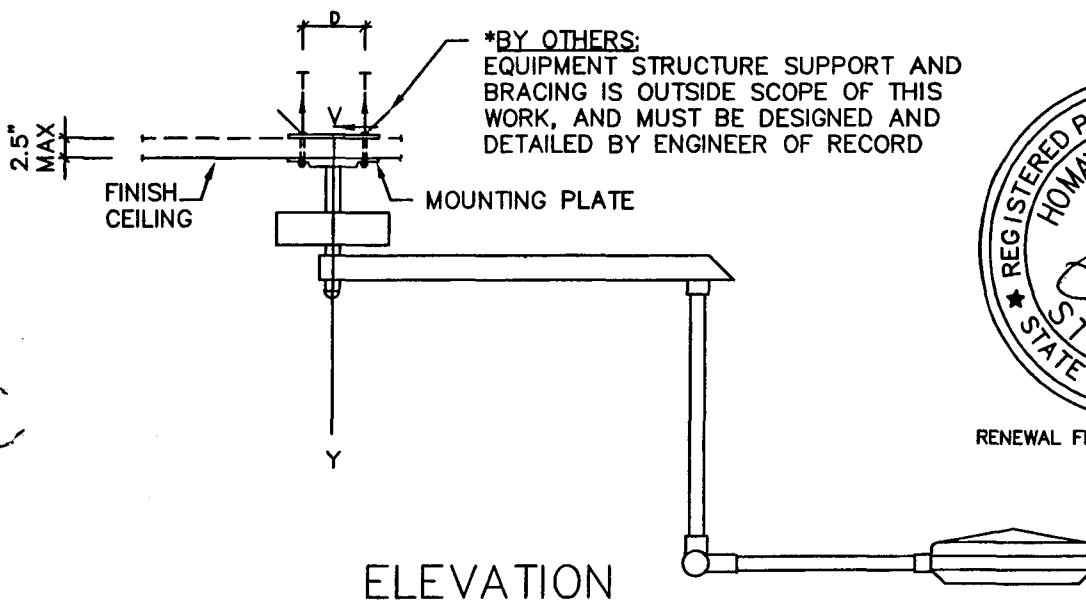| SKYTRON SURGICAL PRODUCTS | DES. | SHEET |
|---|---|---|
| STELLAR SERIES - ST 23 CUSTOM<br>FOR SEISMIC ZONE (4), SOIL PROFILE (Sd)<br>NEAR SOURCE FACTOR = 1.5 | FCE JOB No.<br><br>DATE: 6-21-03 | 1<br>OF 4 SHEETS |

## SEISMIC ANCHORING BOLT DESIGN
## ST23 CUSTOM



*BY OTHERS:
EQUIPMENT STRUCTURE SUPPORT AND
BRACING IS OUTSIDE SCOPE OF THIS
WORK, AND MUST BE DESIGNED AND
DETAILED BY ENGINEER OF RECORD

2.5" MAX

FINISH CEILING

MOUNTING PLATE

ELEVATION

NOTES:

1. SCOPE OF WORK: DESIGN OF BOLTS CONNECTING MOUNTING PLATE
   TO STRUCTURE ONLY.

2. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE –
   SECTION 1632A, (INCLUDING UP TO DATE REVISIONS) AND HAVE BEEN
   FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE

3. FORCES ARE MAXIMUMS AND OCCUR WHEN EQUIPMENT IS MOVED TO
   ITS MOST ECCENTRIC POSITION.

4. PROVIDE CEILING STRUCTURE DESIGNED AND DETAILS TO SUPPORT
   WEIGHTS AND FORCES SHOWN (BY ENGINEER OF RECORD FOR THE BUILDING)

5. ENGIINEER OF RECORD TO DESIGN, DETAIL AND VERIFY STRUCTURE AND/
   OR EXISTING  LIGHT SUPPORT TRACTS TO SUPPORT INDICATED LOADS

6. HORIZONTAL FORCES AND MOMENT MAY OCCUR IN ANY DIRECTION,
   ACTING AT THE TOP OF MOUNTING PLATE.

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| STELLAR SERIES - ST 23 CUSTOM FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5 | FCE JOB No. | **2** |
| | DATE: 6-21-03 | OF 4 SHEETS |

## DESIGN CRITERIA:

FORMULA 32A-1: $F_P = 4.0\ Ca*Ip*Wp$

TABLE 16A-Q : $Ca = 0.44*Na = 0.44*1.5 = 0.66$ ( For zone 4 & $S_D$)

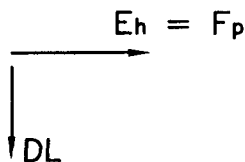TABLE 16A-K : $Ia = 1.5$ ( For essential facility)
$$\therefore F_P = (4.0)(0.66)(1.5)Wp = 3.96\ Wp \text{ (For LRFD)}$$
$$F_P = 3.96Wp/1.4 = 2.83Wp \text{ (For ASD)}$$

FORMULA 30A-1: $E = p*Eh + Ev$
$Eh = Fp$
$p = 1.0$ (FOR COMPONENT)
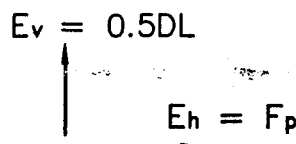
$Ev = (0.5)Ca*Ip*Wp$
$= (0.5)(0.66)(1.5)Wp = 0.5Wp$ (For LRFD)
$= 0$ (For ASD)

SECTION 1630A.11: $Ev = (0.7)Ca*I*Wp$
$= (0.7)(0.66)(1.5)/1.4 = 0.5Wp$ (For ASD) [NET UPLIFT FORCE]

## LOAD COMBINATION CASE A

$Eh = Fp$

$DL$

## LOAD COMBINATION CASE B

$Ev = 0.5DL$

$Eh = Fp$

BY COMPARISION LOAD, COMBINATION A GOVERNS

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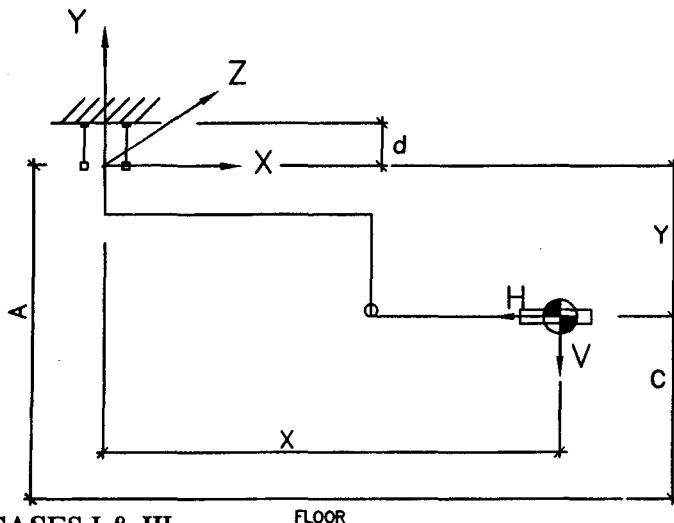| SKYTRON SURGICAL PRODUCTS | DES. | SHEET |
| --- | --- | --- |
| STELLAR SERIES - ST 23 CUSTOM<br>FOR SEISMIC ZONE (4), SOIL PROFILE (Sd)<br>NEAR SOURCE FACTOR = 1.5 | FCE<br>JOB No.<br><br>DATE: 10-08-03 | **3**<br><br>OF  4   SHEETS |

CASES I & III



S : Shear/bolt
moment/bolt: m
t: Direct tension/bolt
t': Flexual tension/bolt
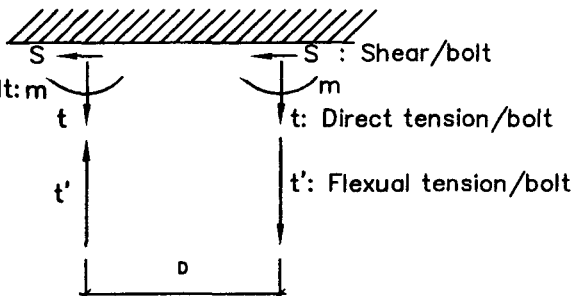


CASES II & IV

A: MAX FLOOR TO MOUNTING PLATE DISTANCE
$A = 10'-0" = 120"$
$C = 80"$
Vd : Dead Load
Ve : Vertical Seismic Load
He : Horizontal Seismic Load

## CASE I   ( FIXTURE AT HIGH POSITION)

$d = 2.5"$
$D = 9.5"$
$Vd = 141 \#$
$Y = A - C = 120 - 80 = 40"$
$X = 114"$
$Ve = 0.50 \times 141 = 69.8 \#$
$He = 2.83 \times 141 = 398.8 \#$
$S = 398.8 / 4 = 99.7 \#per\ bolt$
$t = (141 + 69.8)/4 = 52.7\#$  per bolt
Total $Mzz = (141 + 69.8) \times 114 + 398.8 \times 40 = 39984 "\#$
$t' = 39984 /(9.5 \times 2) = 2104 \#$ per bolt
$m = 99.7 \times 2.5 = 249 "\#$  per bolt

## CASE II ( FIXTURE AT HIGH POSITION)

$d = 2.5"$
$D = 9.5"$
$Vd = 141 \#$
$Y = A - C + 35 = 75"$
$X = 79"$
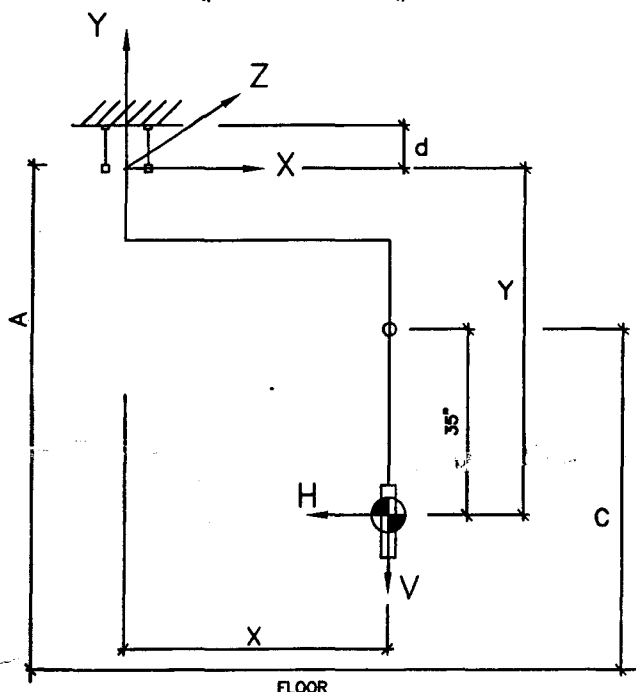$Ve = 0.50 \times 141 = 69.8 \#$
$He = 2.83 \times 141 = 398.8 \#$
$S = 398.8 / 4 = 99.7 \#$ per bolt
$t = (141 + 69.8)/ 4 = 52.7 \#$ per bolt
Total $Mzz = (141 + 69.8) \times 79 + 398.8 \times 75 = 46565 "\#$
$t' = 46565 /(9.5 \times 2) = 2451 \#$  per bolt
$m = 99.7 \times 2.5 = 249.3 "\#$ per bolt

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| | DATE: 10−08−03 | OF 4 SHEETS |

**CASE III** (Same As CASE I, Lateral Forces Applied Diagonaly To Mounting Plate)

$d = 2.5$ "
$R = 13.4$ "
$Vd = 141$ #
$Y = 40$ "
$X = 114$ "
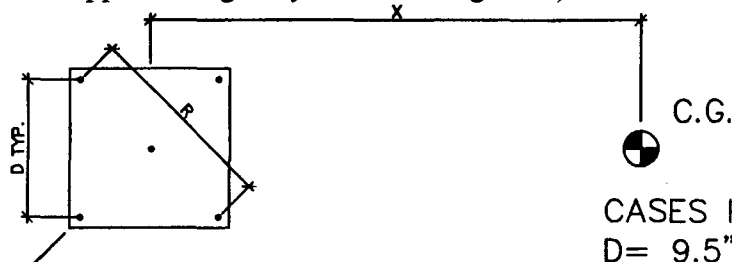$Ve = 0.50 \times 141 = 69.8$ #
$He = 2.83 \times 141 = 398.8$ #
$S = 398.8 / 4 = 99.7$ #  per bolt
$t = (141 + 69.8)/4 = 52.7$ #  per bolt
Total $Mzz = (141 + 69.8) \times 114 + 398.8 \times 40 = 39984$ "#
$t' = 39984 /(13.4 \times 1) = 2976$ #  per bolt
$m = 99.7 \times 2.5 = 249.3$ "#  per bolt

C.G.

CASES I & II
D= 9.5"

**CASE IV**
(Same As CASE II, Lateral Forces Applied Diagonaly To Mounting Plate)

$d = 2.5$ "
$R = 13.4$ "
$Vd = 141$ #
$Y = 75$ "
$X = 79$ "
$Ve = 0.50 \times 141 = 69.8$ #
$He = 2.83 \times 141 = 398.8$ #
$S = 398.8 / 4 = 99.7$ #  per bolt
$t = (141 + 69.8)/4 = 52.7$ #  per bolt
Total $Mzz = (141 + 69.795) \times 79 + 398.8 \times 75 = 46565$ "#
$t' = 46565 /(13.4 \times 1) = 3466$ #  per bolt  GOVERNS
$m = 99.7 \times 2.5 = 249.3$ "#  per bolt

C.G.

CASES III & IV
R= 9.5(2)^0.5 = 13.4"

**CHECK 3/4" DIA. A307 BOLTS:**

ALLOWABLE TENSION:   8,800 #
ALLOWABLE SHEAR:     4,400 #

$S = 3.14 * d^3/32 = 3.14 \times (0.75)^3/ 32 = 0.04$ "3
$fb = 249.3 / 0.04 = 6021$ PSI
$Fb = 0.75 \times 36000 = 27000$ PSI

$fv/Fv + ft/Ft + fb/Fb = 0.02 + 0.39 + 0.22 = 0.63 < 1.0$  OK

USE 7/8" DIA. A307 BOLTS